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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/671,812	09/25/2003	Claire Richtarch	4717-11300	6886

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EXAMINER	
LINDSAY JR, WALTER LEE	
ART UNIT	**PAPER NUMBER**
2812	

DATE MAILED: 03/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/671,812	RICHTARCH, CLAIRE	
	Examiner	Art Unit	
	Walter L. Lindsay, Jr.	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,6-14 and 16-19* is/are rejected.

7)☒ Claim(s) *5 and 15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *5/7/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to an Application filed 7/23/2003.

Currently, claims 1-19 are pending.

Specification

1. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 17 and 19 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claim 17 recites the limitation "the method of claim" in line 1. There is insufficient antecedent basis for this limitation in the claim.

No claim is specified to show what claim, claim 17 is dependent from. Examiner chooses to examine the claim as though it reads from claim 1.

5. Claim 19 recites the limitation "the method of claim 19" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 19 depends upon itself. Examiner chooses to examine the claim as though it reads from claim 1.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 1, 4, 10-14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Augustine et al. (U.S. Patent No. 5,895,583 dated 4/20/1999) in view of Ueno (U.S. Patent No. 6,136,727 dated 10/24/2000) and Ogino et al. (Japanese Publication No. 07-288243 dated 10/31/1995).

Augustine shows the method substantially as claimed in Figs. 1-5C and corresponding text as: polishing the conditioned SiC surface of the wafer (40) with an abrasive in order to provide a wafer surface that is suitable for growing an epitaxial layer thereon (col. 3, lines 30-45) (claim 1). Augustine teaches that the polishing is conducted with a polishing head that is rotated at about 10 rpm to about 100 rpm (col. 4, lines 6-16) (claim 11). Augustine teaches that a pressure of about 0.1 bar to about 1 bar is applied to the polishing head during rotation (col. 4, lines 23-32) (claim 12).

Augustine teaches that the wafer surface is polished for about 15 minutes to about 30 minutes (col. 4, lines 45-51) (claim 13). Augustine teaches that the polishing is conducted with an IC1000 type polishing pad (col. 4, lines 33-44) (claim 14). Augustine teaches that the polishing is conducted to provide a surface roughness of less than 15 angstroms RMS (col. 4, lines 52-58).

Augustine lacks the anticipation of explicitly teaching that: 1) annealing the wafer in an oxidizing atmosphere to condition the SiC surface (claim 1); and 2) the annealing is conducted at a temperature of about 1000°C to about 1300°C (claim 4).

Ueno forms a silicon carbide device in an oxidizing atmosphere. The SiC wafer is inserted into an oxidizing furnace and then heated to 1100°C (col. 4, lines 52-63). This process is to increase the value of channel mobility an important characteristics of a semiconductor device having excellent characteristics (col. 2, line 65-col. 3, line 3).

It would be obvious to one of ordinary skill in the art, at the time the invention was made, to modify the method of Augustine by annealing the wafer in an oxidizing atmosphere to condition the SiC at a temperature of about 1000°C to about 1300°C, as taught by Ueno, with the motivation that Ueno teaches that by implementing the oxidation the value of channel mobility is increased.

Augustine as modified by Ueno lacks anticipation of explicitly teaching that: 1) polishing the conditioned SiC surface of the wafer with an abrasive based on particles of colloidal silica in order to provide a wafer surface that is suitable for growing an epitaxial layer thereon (claim 1); and 2) the colloidal silca particles used for polishing the wafer surface include Syton W30 type colloidal silica (claim 10).

Ogino shows the of a colloidal silica being with a pH of 10-15 being used in a suspension that is then used to polish the surface of a silicon carbide substrate (Basic Abstract). The advantages are that the colloidal silica exerts mechano-chemical action to provide a good polished surface on the silicon surface and that no mechanical defects or crystal distortions appear on the polished surface of the silicon carbide. (Advantage).

It would be obvious to one of ordinary skill in the art, at the time the invention was made, to modify Augustine as modified by Ueno by polishing the SiC with colloidal silica as taught by Ogino, with the motivation that Ogino teaches that colloidal silica provides a good polish and that no mechanical defects or crystal distortions appear on the polished surface of the silicon carbide.

9. Claims 3, 16 and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Augustine et al. (U.S. Patent No. 5,895,583 dated 4/20/1999) in view of Ueno (U.S. Patent No. 6,136,727 dated 10/24/2000) and Ogino et al. (Japanese Publication No. 07-288243 dated 10/31/1995) as applied to claim 1 above, and further in view of Goesele et al. (U.S. Patent No. 5,877,070 dated 3/2/1999).

Augustine as modified by Ueno and Ogino lack anticipation of explicitly teaching that: 1) the SiC surface layer is bonded to a semiconductor substrate (claim 3); 2) the polishing is conducted to make the wafer surface suitable for homoepitaxy or heteroepitaxy (claim 16); 3) an epitaxial layer is deposited upon the polished wafer surface (claim 18); and 4) the epitaxial layer comprises at least one of SiC, AlN, GaN or AlGaN (claim 19).

Goesele teaches the formation of a silicon carbide substrate (col. 11, lines 39-48). Then a gallium nitride epitaxial layer is then bonded to the silicon carbide substrate (col. 12, lines 25-39). The process has the essentially flat and mirror polished silicon carbide and bonding it to a flat and mirror polished gallium nitride (col. 3, lines 46-50). The process allows for several thin layers to be formed from the same substrate (col. 1, lines 6-15).

It would be obvious to one of ordinary skill in the art, at the time the invention was made, to modify Augustine as modified by Ueno and Ogino by bonding and growing an epitaxial layer on the SiC that is either homoepitaxy or heteroepitaxy and consist of a layer from the group of SiC, AlN, GaN or AlGaN, as taught by Goesele with the motivation that Goesele teaches that several thin layers can be formed from the same substrate.

10. Claims 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Augustine et al. (U.S. Patent No. 5,895,583 dated 4/20/1999) in view of Ueno (U.S. Patent No. 6,136,727 dated 10/24/2000) and Ogino et al. (Japanese Publication No. 07-288243 dated 10/31/1995) as applied to claim 1 above, and further in view of Tanimoto et al. (U.S. Patent No. 6,833,562 filed 12/2/2002).

Augustine as modified by Ueno and Ogino lack anticipation of explicitly teaching that: 1)at least one of deoxidizing the wafer surface or utilizing an RCA (SC1, SC2) type chemical cleaning step prior to polishing (claim 6); 2) the wafer surface is deoxidized with hydrofluoric acid (claim 7); 3) chemically cleaning the wafer surface prior to polishing (claim 8); and the wafer surface is cleaned with hydrofluoric acid (claim 9).

Tanimoto shows the cleaning of a SiC substrate. The substrate is sufficiently washed by RCA cleaning. Thereafter the substrate is immediately immersed in hydrofluoric acid buffer solution so as to remove the thermal oxide films (col. 10, line 59-col. 11, line 12). The cleaning process reduces causes of a thermal loss and of operating speed reduction and to form high performance gate insulating film (col. 1, lines 43-53).

It would be obvious to one of ordinary skill in the art, at the time the invention was made, to modify Augustine as modified by Ueno and Ogino by cleaning the substrate through a RCA step followed by hydrofluoric acid, as taught by Tanimoto, with the motivation that Tanimoto teaches that the cleaning process reduces causes of thermal loss and operating speed reduction and to form high performance gate insulating film.

Allowable Subject Matter

11. Claims 5 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following is a statement of reasons for the indication of allowable subject matter: the prior art, either singly or in combination fails to anticipate or render obvious, the limitations of:

...wherein the annealing is conducted for about 1 hour to about 3 hours, as required by claim 5; and

...comprising etching the wafer surface with ions prior to polishing, as required by claim 15.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Walter L. Lindsay, Jr. whose telephone number is (571) 272-1674. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

WLL
February 9, 2005

MICHAEL S. LEBENTRITT
PRIMARY EXAMINER